

### 3.2: The Product and Quotient Rules

#### Rule 5: The Product Rule

$$\frac{d}{dx}[f(x) \cdot g(x)] = f'(x) \cdot g(x) + f(x) \cdot g'(x)$$

*Note:*

$$\frac{d}{dx}[f(x) \cdot g(x)] \neq f'(x) \cdot g'(x)$$

**Example.** Find the derivative of the following functions

- by expanding
- by using the product rule

$$f(x) = (2x^2 - 1)(x + 3)$$

$$g(x) = x^3(\sqrt{x} + 1)$$

*Note:*

$$\frac{d}{dx}[fghj] = f'ghj + fg'hj + fgh'j + fghj'$$

**Rule 6: The Quotient Rule**

$$\frac{d}{dx} \left[ \frac{f(x)}{g(x)} \right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$$

“Lo De Hi, minus Hi De Lo, over the square of what’s below”

**Example.** Find the derivative of the following functions

$$f(x) = \frac{3x^2 - 4x + 7}{x}$$

$$g(x) = \frac{x}{2x - 4}$$

$$h(x) = \frac{x^2 + 1}{x^2 - 1}$$

$$j(x) = \frac{\sqrt{x}}{x^2 + 1}$$

$$k(x) = \frac{3x(x^2 + 1)}{x^2 - 1}$$